

**CLAIMS**

1. Method of generating line properties of a signal line including generating (401) a frequency dependent line input impedance ( $Z_m(f)$ ) for a loop, the loop including the signal line (2) and a remote device (3), the method being characterized by:
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- Generating (402) an absolute value function ( $|Z_m(f)|$ , A1) from the frequency dependent line input impedance ( $Z_m(f)$ ), the function being essentially periodic;
  - 10 - Selecting (408) at least two consecutive extreme values (Max1;Max2) of the same type of the absolute value function ( $|Z_m(f)|$ );
  - Generating (409) a frequency distance (FD1) based on said at least two extreme values;
  - 15 - Generating (410) a line length value (L) based on the frequency distance (FD1) and a velocity of propagation (vop) for a signal on the signal line (2).
2. Method of generating line properties of a signal line according to claim 1, wherein the frequency distance is a mean value (MV1,MV2,MV3) between at least two different frequency distances (FD1-FD4), each of which reaches between two consecutive ones of the extreme values (Max1,Max2,Max3; Min1,Min2,Min3) of the same type.
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3. Method of generating line properties of a signal line according to claim 1 or 2, the method being performed as a single ended loop test and including:
- 25
- selecting a test transceiver (31) suitable for communication purposes;

- connecting (603), in a calibration process, at least three impedances (9) of each a predetermined value to a signal line connection (5) of the test transceiver (31);
  - generating (606) frequency dependent echo transfer functions ( $H_{echo}(f)$ ) utilizing test signals ( $vt_{in}$ ,  $vt_{out}$ ) and said at least three impedances (9); and
  - generating (608) transceiver model values ( $Z_{h0}(f)$ ,  $Z_{hyb}(f)$ ,  $H_{\infty}(f)$ ) with the aid of said echo transfer functions ( $H_{echo}(f)$ ) and the corresponding impedance values (9), said model values including an echo transfer function ( $H_{\infty}(f)$ ) for the test transceiver (31) with open line connection (5), a transceiver impedance value ( $Z_{hyb}(f)$ ) as seen from the line (2) side and a product ( $Z_{h0}(f)$ ) of said transceiver impedance value ( $Z_{hyb}(f)$ ) and an echo transfer function ( $H_0(f)$ ) for the transceiver (31) with shortcut line connection (5).
4. Method of generating line properties of a signal line according to claim 3 including storing (609) the transceiver model values ( $Z_{h0}(f)$ ,  $Z_{hyb}(f)$ ,  $H_{\infty}(f)$ ) obtained in the calibration process.
5. Method of generating line properties of a signal line according to claim 4 including:
- selecting (610) a transceiver (1) for communication purposes of the same type of hardware as said test transceiver (31) in the calibration process;
  - connecting (701) the loop to the transceiver (1);
  - sending (702), via the connected transceiver (1), a loop test signal ( $v_{in}$ ) to the line (2);

- measuring (703), via said transceiver (1), the loop test signal ( $v_{out}$ ) as reflected;
- generating (704) a loop echo transfer function ( $H_{echo}(f)$ ) for the loop (2,3);
- 5 - generating (705) the frequency dependent line input impedance value ( $Z_{in}(f)$ ) for the loop (2,3) with the aid of the stored transceiver model values ( $Z_{h0}(f)$ ,  $Z_{hyb}(f)$ ,  $H_{\infty}(f)$ ) and the generated echo transfer function ( $H_{echo}(f)$ ).
- 6. Method of generating line properties of a signal line according to claim 1, 2 or 5, wherein a short loop length decision value ( $dValue$ ) is estimated, the method including:
  - generating, in a predetermined loop length frequency range ( $f_1-f_2$ ), an impedance mean value ( $mValue$ ) of the absolute value ( $|Z_{in}(f)|$ ) of the line input impedance ( $Z_{in}(f)$ );
  - 15 - generating, in the loop length frequency range, the short loop length decision value ( $dValue$ ) based on the line input impedance ( $Z_{in}(f)$ ) and said impedance mean value ( $mValue$ );
  - comparing the short loop length decision value ( $dValue$ ) with a predetermined threshold value ( $thValue$ );
  - 20 - deciding the loop to be a short loop based on said comparison.
- 7. Method of generating line properties of a signal line according to claim 1, 2, 5 or 6 including:
  - 25 - calculate an average attenuation value ( $AA1$ ) for a selected set of telecommunication cables;
  - estimate the length ( $L$ ) of the short signal line (2);

- generate an attenuation value (LA1) for the line (2) by multiplying the average attenuation value (AA1) with the line length (L).

8. Method of generating line properties of a signal line  
5 according to claim 1, 2, 5 or 6 including:

- selecting one of the minimum values (Min1) of the absolute value function ( $|Z_m(f)|$ , A1) and an adjacent of the maximum values;
- generating an insertion loss (loss) value for the line (2)  
10 based on said minimum and maximum values.

9. An arrangement for generating line properties of a signal line, the arrangement including a front end device (MD1;1) having connections (5) for a loop including the signal line (2) and a remote device (3), the arrangement including  
15 circuits (LU1;42,42,43) in the front end device (MD1;1) for generating a frequency dependent line input impedance ( $Z_m(f)$ ) for the loop, the arrangement being characterized by:

- a calculation unit (CU1;11) for generating an absolute  
20 value function ( $|Z_m(f)|$ ) from the frequency dependent line input impedance ( $Z_m(f)$ ), the function being essentially periodic;

- circuits in the calculation unit (CU1;11) suitable for:

a). selecting at least two consecutive extreme values  
25 (Max1,Max2) of the same type of the absolute value function ( $|Z_m(f)|$ );

b). generating a frequency distance (FD1) based on said at least two extreme values;

c). generating a line length value (L) based on the frequency distance (FD1) and a velocity of propagation (vop) for a signal on the signal line (2).

10. An arrangement for generating line properties of a  
5 signal line according to claim 9, wherein the calculation unit (CU1;11) is arranged for calculating a mean value (MV1,MV2,MV3) between at least two different ones of the frequency distances (FD1-FD4), each of which reaches between two consecutive ones of the extreme values (Max1,Max2,Max3;  
10 Min1,Min2,Min3) of the same type.

11. An arrangement for generating line properties of a  
signal line (2) according to claim 9 or 10, wherein the  
front end device is a transceiver (1,31) for communication  
15 purposes, the arrangement in a calibration mode including:

- a test transceiver (31) connected to a measurement device (32);
- the measurement device (32) being arranged to generate, in a calibration process, calibration values for the  
20 transceiver (1,31) for communication purposes with the aid of at least three impedances (9) and test signals ( $v_{t_{in}}$ ,  $v_{t_{out}}$ ), the impedances (9) having each a predetermined value and being connected to the line connection (5) of the test transceiver (1, 31);
- 25 - the measurement device (32) being arranged to generate a frequency dependent echo transfer function ( $H_{echo}(f)$ ) for the test transceiver (1,31) connected to the respective one of the impedances (9);
- the measurement device (32) being arranged to generate  
30 transceiver model values ( $Z_{ho}(f)$ ,  $Z_{hyb}(f)$ ,  $H_{\infty}(f)$ ) with the aid

- of said echo transfer function ( $H_{echo}(f)$ ) and the corresponding impedance values (9), said model values including an echo transfer function ( $H_{\infty}(f)$ ) for the transceiver (1, 31) with open line connection (5), a  
5 transceiver impedance value ( $Z_{hyb}(f)$ ) as seen from the line (2) side and a product of said transceiver impedance value ( $Z_{hyb}(f)$ ) and an echo transfer function ( $H_0(f)$ ) for the transceiver (1, 31) with shortcut line connection (5); and
- 10 - the transceiver for communication purposes (1,31) being arranged to generate the frequency dependent line input impedance ( $Z_{in}(f)$ ) with the aid of the transceiver model values ( $Z_{h0}(f), Z_{hyb}(f), H_{\infty}(f)$ ).
12. An arrangement for generating properties of a signal.  
15 line (2) according to claim 11, the arrangement including a memory (12, 33) for storing the transceiver model values ( $Z_{h0}(f), Z_{hyb}(f), H_{\infty}(f)$ ).